



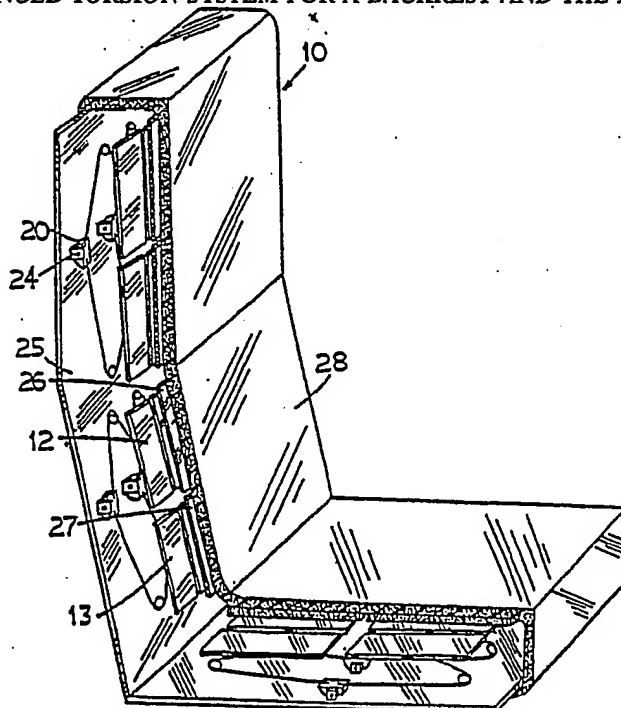
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## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(21) International Application Number: PCT/CA92/00312 (22) International Filing Date: 23 July 1992 (23.07.92) (30) Priority data: 2,049,580        20 August 1991 (20.08.91)    CA (71)(72) Applicant and Inventor: ZHANG, Yun, Hui [CN/CA]; 52 Oak Avenue, Richmond Hill, Ontario L4C 6R7 (CA). (74) Agent: WONG, David, W.; 46 Willowbrook Road, Thornhill, Ontario L3T 4W9 (CA). (81) Designated States: AU, JP, KR, RU, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LU, MC, NL, SE).	Published <i>With international search report.</i>	

(54) Title: A PRESSURE BALANCED TORSION SYSTEM FOR A BACKREST AND THE LIKE



## (57) Abstract

A pressure balanced torsion system for use in a backrest and the like comprises a plurality of pairs of pressure bearing plates (12, 13) coupled to a torsion spring means. The torsion spring means (14, 15) is pivotally mounted to a support back plate (25). When an external pressure is exerted onto the pressure bearing plates (12, 13) by a human body resting against them, the counter reactive force generated by the torsion spring (14, 15) in the system will cause both pressure bearing plates (12, 13) to push against the human body until the counter reactive force is balanced in both pressure bearing plates; thus providing a balanced counter pressure against the human body to provide a uniform support therefor.

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A PRESSURE BALANCED TORSION SYSTEM FOR A BACKREST AND THE LIKE  
BACKGROUND OF THE INVENTION

This invention relates to a body support system and more particularly relates to a torsion system suitable for use in a backrest and the like, which is self-adjusting to a pressure  
5 balanced state to conform to the human body contour so as to provide a complete support therefor even as the body moves relative to the support.

Commonly, backrests do not provide a full support to the human body resting against it, mainly because of the irregular  
10 curvature of the back in the human body. Some back rests attempt to provide a better support to the human body by providing various protrusions at predetermined fixed locations therein so that all areas of the back of the human body are in contact with a fixed support when resting against the same.  
15 Such fixed backrests do not provide any reactive pressure to support the human body.

Another common support uses a plurality of compression and/or tension springs. In such system, a plurality of such compression springs, such as coil springs, are mounted within  
20 a collapsible frame bounded with an outer covering material. When a person rests against such system, the coil springs at the various areas are being compressed by the human body so that the system in the backrest or mattress would conform with the contour of the human body to provide a support therefor.  
25 However, the main drawback of such system is that only the springs being compressed would exert a counter reactive force against the corresponding areas of the human body exerting the compression force thereto. The curved-in or depression areas of the human body which are not in contact with the back rest  
30 would not receive any reactive force from the backrest. Therefore, such system do not provide a uniform pressure

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balanced support to the human body resting against it, resulting in the muscle in the unsupported areas to tense up. The long term effect in using such backrest and mattress would result in body fatigue and the development of muscle pain.

5 SUMMARY OF THE INVENTION

It is a principal object of the present invention to provide a body support system which exerts a balanced counter force against the body resting against it for providing a uniform support therefor.

10 It is another object of the present invention to provide a body support system which reacts to the body movement to provide a constant uniform balanced support to the body.

It is another object of the present invention to provide a pressure balanced torsion system which is relatively simple  
15 in construction.

Briefly, the system according to the present invention comprises a plurality of pairs of torsion operative means mounted on a substantially rigid support plate member. Each pair of the torsion operative means including a rocker member  
20 pivotally mounted on said support plate member. A torsion spring means is coupled to the rocker member. The torsion spring means has a first free end and a second free end. A first pressure bearing plate means having a pressure receiving surface and a rear surface opposite to the pressure receiving  
25 surface. The first free end of the torsion spring means is pivotally coupled to the rear surface of the first pressure bearing plate means. A second pressure bearing plate means having a pressure receiving surface and a rear surface opposite to the pressure receiving surface. The second free  
30 end of the torsion spring means is pivotally coupled to the rear surface of the second pressure bearing plate means. The pressure receiving surface of the first and second pressure bearing plate means are operative to provide a pressure

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balanced support to a human body resting against them.

Other objects of this invention will appear in the following description and appended claims, reference being made to the accompanying drawings.

5 BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a partial cut-away perspective elevation view of a seat having a pressure balanced torsion system in its backrest and seat areas therein according to the present invention.

10 Figure 2 is a perspective elevation view of the pressure balanced torsion system according to the present invention.

Figure 3 is a perspective elevation view of the torsion spring means used in the torsion system according to the present invention.

15 Figure 4 is a partial cut-away perspective view of the rocker member in the torsion system according to the present invention.

Figure 5 is a top elevation view of the rocker member thereof.

20 Figure 6 is a side elevation view of the rocker member thereof.

Figure 7 is a perspective elevation view of the mounting bracket for the rocker means thereof.

25 Figure 8 is a schematic diagram showing the operation of the pressure balance torsion system according to the present invention.

Figure 9 is a schematic diagram showing the operation of two torsion systems in a backrest with the pressure bearing plates abutting intimately with the covering to conform with  
30 a human body contour according to the present invention.

Figure 10 shows a two-level construction of the torsion system according to the present invention.

Figure 11 is a perspective elevation view of the torsion

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system using a torsion spring having a second embodiment.

Figure 12 is a perspective elevation view of a third embodiment having a torsion spring with a flat body.

Figure 13 is a perspective elevation view of a fourth embodiment of the torsion system having a single torsion spring according to the present invention.

Figure 14 is a perspective elevation view of a fifth embodiment of the torsion system having a single plate type torsion spring.

#### 10 DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

With reference to the drawings wherein like reference numerals designate corresponding parts in the several views, a seat 10 is shown having the pressure balanced torsion system 11 according to the present invention incorporated therein. As 15 generally shown in Figure 2, the torsion system according to the present invention comprises a plurality of pairs of upper pressure bearing plates 12 and lower pressure bearing plates 13. These pressure bearing plates may be made of a rigid sheet material such as plastic, sheet metal, fibre board or wood 20 board. Each pair of the pressure bearing plates 12 and 13 is coupled to a torsion spring assembly which consists of two substantially V-shaped elongated torsion springs 14 and 15. Each of these torsion springs has a longer arm 16 and a shorter arm 17 as best shown in Figure 3. The free end of the 25 shorter arm 17 is provided with a short right angled portion 18 which is pivotally coupled to the rear surface of the pressure bearing plate. The free end of the longer arm 16 is provided with a right angled end portion 19 which is pivotally mounted to a rocker member 20 as shown in Figure 2. The rocker 30 member 20 has a semi-circular shape as best shown in Figures 4, 5 and 6. A transverse through opening 21 is formed in the middle thereof, and two cross openings 22 and 23 extend perpendicular to the transverse through opening 21 from the

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arcuate edge to the flat edge therein for coupling with the right angled end portion of the torsion springs 14 and 15. The rocker member 20 is pivotally mounted on a U-shaped bracket 24 which, in turn, is mounted fixedly to the back plate 25. The  
5 plurality of upper pressure bearing plates 12 are secured to a flexible retaining sheet 26 such as by adhesive. The plurality of lower pressure bearing plates 13 are secured to another flexible retaining sheet 27 in the similar manner.

As generally shown in Figure 1 the seat 10 may be provided with three such pressure balanced torsion assemblies, and the entire over all assembly is covered by an external foam-like flexible covering sheet 28.

The operation of the pressure balanced torsion system will now be described with reference to the schematic diagram  
15 shown in Figure 8. In the normal condition, the pressure bearing plates 12 and 13 are in the positions shown by the solid lines. However, when an external pressure is applied to the lower pressure plate 13, for example, as shown by the solid arrows 29 such as applied by a human body resting  
20 against the pressure bearing plate 13, it will cause the lower pressure bearing plate 13 to move to the second position as shown by the dotted lines against the reactive torsion force of the spring 15. The distance travelled depends upon the degree of the pressure applied onto the pressure bearing plate  
25 13. Also, it will cause the entire torsion assembly to pivot relative to the rocker member 20, thus resulting in pushing the upper pressure bearing plate 12 to move to the dotted line position from the solid line position. The upper pressure bearing plate 12 will then press outwards to abut the area of  
30 the human body opposite to such location, while the same location of the human body may also be exerting a pressure on the pressure bearing plate 12 against the torsion force of the spring 14. In this manner, the entire system acting and

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reacting to the external pressure will eventually come to a stable position in which the external force and the reactive torsion force will be balanced to each other to maintain both the upper and lower pressure bearing plates 12 and 13 pressure  
5 intimately against the human body with a same amount of force to provide a comfortable full support therefor.

It can be appreciated by those skilled in the art that the torsion assembly will react quickly to the changing movement of the human body to maintain always a balanced  
10 reactive pressure against the entire area of the human body in contact with the system and to conform fully with the body contour.

The operation and reaction of the system may be further improved by the addition of a second level torsion assembly 30  
15 located between the upper and lower torsion assemblies and the back plate 25. The second level torsion assembly 30 is similar in construction to the upper and lower torsion assemblies. The rocker member 20 of the upper torsion assembly is pivotally mounted to the free end of the upper torsion spring 31, and  
20 the rocker member 20 of the lower torsion assembly is pivotally mounted to the free end of the lower torsion spring 32 therein. The rocker member 33 of the second level torsion assembly is then pivotally mounted to the back plate 25 by the U-shaped bracket 34. In such construction the second level  
25 torsion assembly 30 will cooperate with the primary torsion assemblies to provide a softer but smoother reactive torsion support to the body resting against it.

Obviously, numerous modifications and variations of the present invention are possible in light of the above  
30 teachings. It is therefore to be understood that within the scope of the appended claims, the invention may be practised otherwise than as specifically described above. For example, the torsion spring may have various configurations as shown in

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Figures 11, 12 and 13. As shown in Figure 11, a coil 35 may be formed in the torsion springs 14 and 15 so as to provide a stronger reactive torsion force therein. Also, the free ends of the springs 14 and 15 may be bent 90 degrees to provide a right-angled end portion which can be expeditiously and pivotally mounted to a sleeve portion 36 provided at the rear surface of the pressure bearing plates 12 and 13. The torsion springs may be flat springs such that their free ends may be conveniently secured to the pressure bearing plates with securing clamps 37 as best shown in Figure 12. As shown in Figure 13, the spring may be in the form of a single torsion spring having a coil formed at its middle. The rocker member 20 may then be provided by a round disc forced fitted at the coil. Furthermore, the single torsion spring may be in the form of a substantially C-shaped plate type torsion spring as best shown in Figure 14. In such embodiment, the pressure bearing plates may be eliminated, if the plate type torsion spring has a relatively large width, so that the free end portions of the spring can serve directly as the pressure bearing plates. Also, the rocker member may be in the form of a disc or sleeve mounted on the spring.

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I claim:

1. A pressure balanced torsion system for use in a backrest and the like, comprising

5 a first pressure bearing plate means and a second pressure bearing plate means, each of said first pressure bearing plates means and second pressure bearing plate means having a front surface and a rear surface opposite to said front surface,

10 an elongated torsion spring means including a first arm portion having a free end therein pivotally mounted to said rear surface of said first pressure bearing plate means, and a second end therein mounted to one side of a rocker member, said torsion spring means including a second arm portion having a free end therein pivotally mounted to said rear  
15 surface of said second pressure bearing plate means, and a second end therein mounted to a second side of said rocker member, said second side of said rocker member being directly located opposite to said one side,

20 said rocker member being pivotally mounted on a bracket member, and said bracket member being mounted on a fixed support plate.

2. A pressure balanced torsion system according to Claim 1 including a first sleeve means disposed on said rear surface of said first pressure bearing plate means, and said free end  
25 of said first arm portion of said torsion spring means being pivotally mounted to said first sleeve means,

a second sleeve means disposed on said rear surface of said second pressure bearing plate means, and said free end of said second arm portion of said torsion spring means being  
30 pivotally mounted to said second sleeve means.

3. A pressure balanced torsion system according to Claim 1 wherein said torsion spring means is a flat spring having two flat surfaces.

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4. A pressure balanced torsion system according to Claim 1 wherein said torsion spring means has a coil configuration formed at a middle portion therein, and said rocker member is a round disc secured at said middle portion.

5 5. A pressure balanced torsion system according to Claim 1 wherein said bracket member is a U-shaped bracket mounted fixedly to said support plate.

6. In a human body support device having a plurality of pressure balanced torsion means mounted on a substantially rigid support means, said torsion means comprising,

a U-shaped bracket member mounted on said support means, a rocker member pivotally mounted on said U-shaped bracket member, said rocker member having one side and a second side, and said rocker member being pivotal from said one side to said second side relative to said bracket member,

15 a first pressure bearing plate means having a front surface and a rear surface located opposite to said front surface,

a second pressure bearing plate means having a front surface and a rear surface located opposite to said front surface,

20 an elongated torsion spring means having a first arm portion with a free end therein pivotally mounted to said rear surface of said first pressure bearing plate means, and a second end therein mounted to said one side of said rocker member, said torsion spring means having a second arm portion with a free end therein pivotally mounted to said rear surface of said second pressure bearing plate means, and a second end therein mounted to said second side of said rocker member.

30 7. A human body support system according to Claim 6 including a first flexible retaining means attached to said front surface of said first pressure bearing plate means, and a second flexible retaining means attached to said front

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surface of said second pressure bearing plate means.

8. A human body support system according to Claim 7 including an external covering means disposed over said torsion means and said rigid support means.

5 9. A human body support system according to Claim 8 wherein said flexible retaining means and said external covering means are made of a resilient foam-like material.

10 10. A human body support system according to Claim 9 wherein at least two torsion means are mounted to said rigid support means, said torsion means having a plurality of U-shaped bracket members for an individual pair of first pressure bearing plate means and second pressure bearing plate means.

11. A human body support system according to Claim 10 wherein said two torsion means comprising an upper torsion means, and  
15 a lower torsion means located below said upper torsion means.

12. A human body support system according to Claim 11 including a second elongated torsion spring means located between said two torsion means and said rigid support means, said second elongated torsion spring means having a first arm  
20 portion with a free end therein pivotally mounted to said U-shaped bracket member for a pair of first pressure bearing plate means and second pressure bearing pressure plate means in said upper torsion means, and a second end therein mounted to one side of a additional rocker member, said rocker member  
25 being mounted to said rigid support means, said second elongated torsion spring means including a second arm portion having a free end therein pivotally mounted to said U-shaped bracket member for a pair of first pressure bearing plate means and second pressure bearing plate means in said lower  
30 torsion means, and a second end therein secured to said additional rocker member at a side therein opposite to said one side.

13. A pressure balanced torsion system for use in a backrest

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and the like, comprising

a substantially C-shaped plate type torsion spring member having a first free end portion and a second free end portion located substantially parallel to one another and each having  
5 a front surface operative to bear external pressure exerted thereon,

a rocker member mounted at a middle portion of said torsion spring member, said rocker member being pivotally mounted on a bracket member, and said bracket member being  
10 mounted on a fixed support plate.

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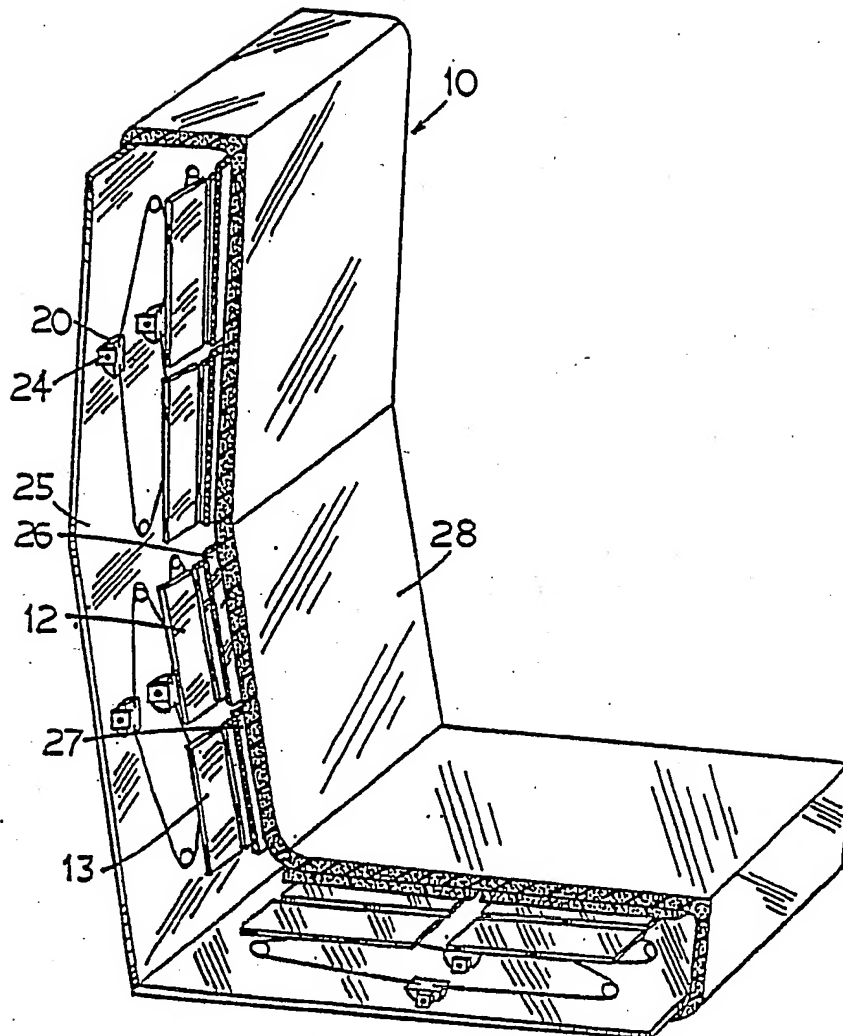


Fig. 1.

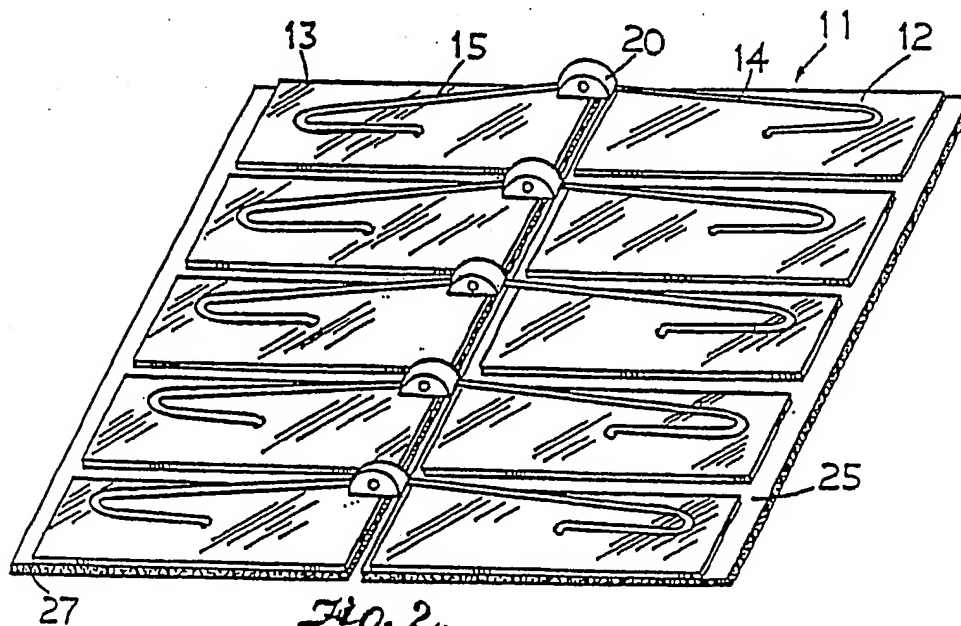
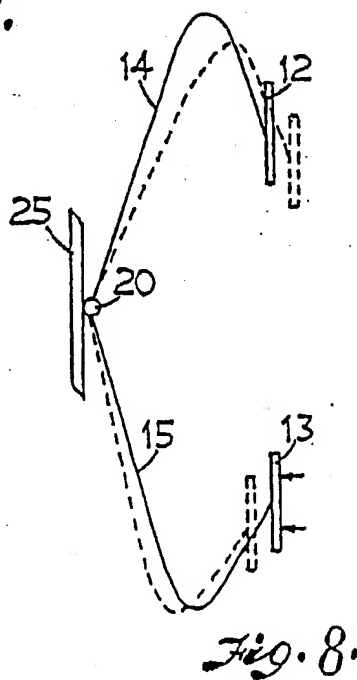
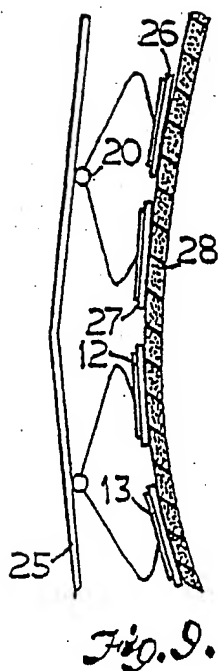
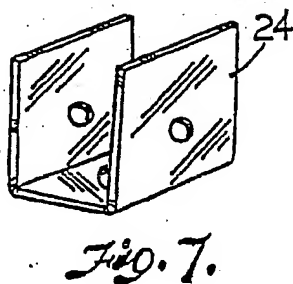
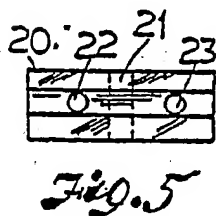
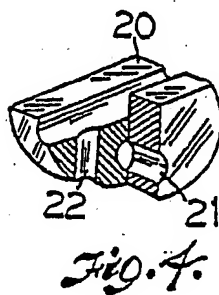
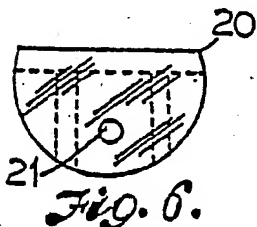
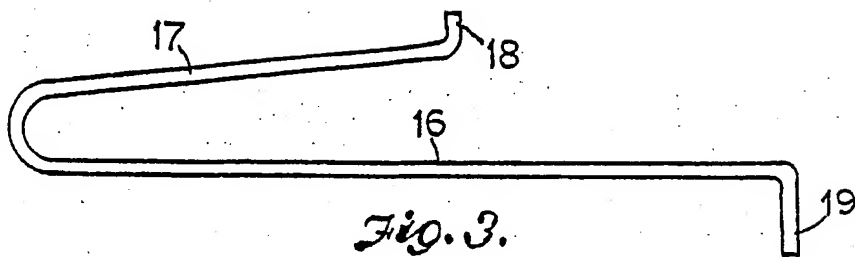


Fig. 2.

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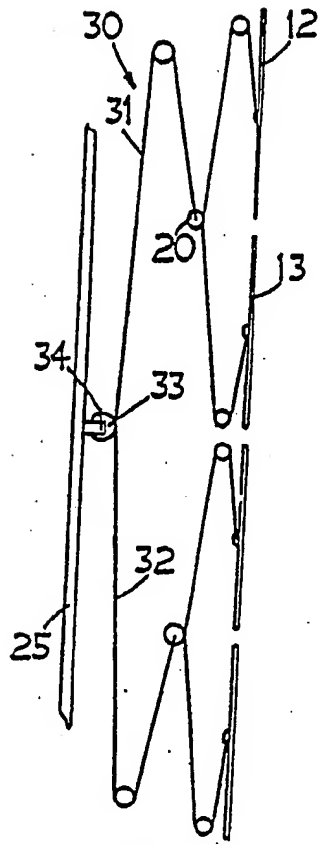


Fig. 10.

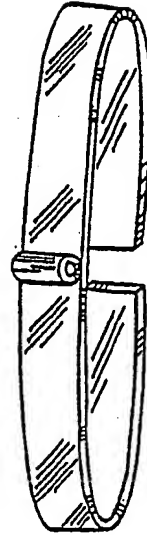


Fig. 14.

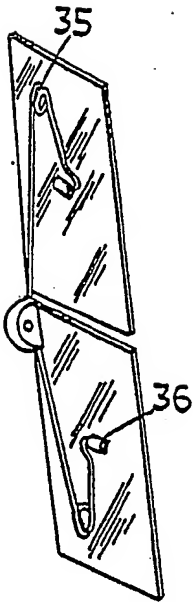


Fig. 11.

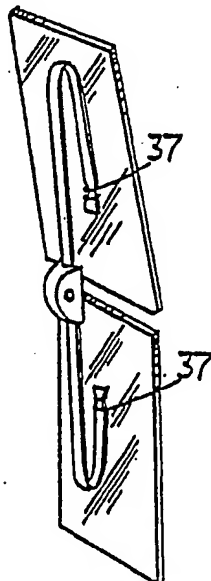


Fig. 12.

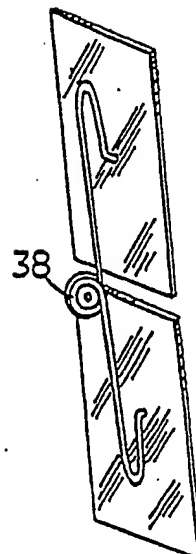


Fig. 13.

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## INTERNATIONAL SEARCH REPORT

PCT/CA 92/00312

International Application No

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (If several classification symbols apply, indicate all) <sup>6</sup>		
According to International Patent Classification (IPC) or to both National Classification and IPC Int.Cl. 5 A47C7/24; A47C23/00		
<b>II. FIELDS SEARCHED</b>		
Minimum Documentation Searched <sup>7</sup>		
Classification System	Classification Symbols	
Int.Cl. 5	A47C	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched <sup>8</sup>		
<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT<sup>9</sup></b>		
Category <sup>10</sup>	Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup>	Relevant to Claim No. <sup>13</sup>
A	US,A,2 293 323 (VIAL ET AL.) 18 August 1942 see the whole document ----	1, 6, 13
A	DE,C,672 258 (SADGROVE) 9 February 1939 see page 3, line 73 - line 80; figure 3 ----	1, 6, 13
A	DE,A,3 234 755 (MÖBELWERK LIPP OHG) 31 March 1983 see page 11, line 8 - page 15, line 17; figures 1,3,5,7 ----	1, 6, 13
A	US,A,4 326 311 (PARIPOVICH) 27 April 1982 see figures 5-8 -----	4
<p><sup>10</sup> Special categories of cited documents:</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&amp;" document member of the same patent family</p>		
<b>IV. CERTIFICATION</b>		
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	
23 SEPTEMBER 1992	02. 11. 92	
International Searching Authority	Signature of Authorized Officer	
EUROPEAN PATENT OFFICE	MYSLIWETZ W.P.	

**ANNEX TO THE INTERNATIONAL SEARCH REPORT  
ON INTERNATIONAL PATENT APPLICATION NO. CA 9200312  
SA 62433**

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US-A-2293323		None	
DE-C-672258		None	
DE-A-3234755	31-03-83	None	
US-A-4326311	27-04-82	None	

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